

Appendix C. Drought Permit Options

C1. Tables Showing Possible Drought Permits

C1.1 Introduction

The Environment Agency may, by means of a drought permit, authorise water companies to take water from specified sources under section 79A of the Water Resources Act 1991 as amended by the Environment Act 1995.

A drought permit application is made directly to the Environment Agency. The application process is described on .gov.uk 'apply for a drought permit or emergency drought order' <https://www.gov.uk/government/collections/apply-for-a-drought-permit-drought-order-or-emergency-drought-order> November 2015. If for whatever reason a drought permit application is refused by the Environment Agency a water company may re-submit the application in the form of a drought order submitted to the Secretary of State for determination. Similarly, drought options that may impact on Habitat Directive (HD) sites would also normally be applied for in the form of a drought order submitted to the Secretary of State.

A drought permit is a supply-side option. The Environment Agency expects water companies to include in their Drought Plans all possible drought permit options. The following table shows a complete summary of Thames Water's possible drought permit options identified to date. This does not preclude the identification of further options at a later date but does represent all those known at the present time.

Table C1 Possible Category 1 Drought Permits

Source	Current licence limit (MI/d)	Potential abstraction with Drought Permit (MI/d)	Potential Gain (MI/d)		WRZ	Issues/ Risks	Priority
			Min estimate	Max estimate			
SWOX							
River Thames @ Farmoor	59.1	59.1 + whatever flow is available	10	30	SWOX	Oxford Watercourses. 30 MI/d preferred. No Likely Significant Effects on the Oxford Meadows SAC. Navigation issues in extreme drought. Reductions in velocity and water quality. Short term effects with respect to Biodiversity, flora and fauna including moderate adverse effects regarding INNS, fish community and moderate risk of short-term deterioration to the fish component of 2 WFD water bodies. Other abstractors.	1
Meysey Hampton	0	Previous summer limit (MI/d)	11.37	11.37	SWOX	No likely significant effects on the North Meadow and Clattinger Farm SAC. Low flows and extension in recovery of flow in surface water (e.g. Ampney Brook). Water quality risk associated with St Peter STW. Potential Cumulative effects with other Cotswolds GW options.	2

Source	Current licence limit (MI/d)	Potential abstraction with Drought Permit (MI/d)	Potential Gain (MI/d)		WRZ	Issues/ Risks	Priority
			Min estimate	Max estimate			
Latton	15 ave (17 month)	20 ave	3	5	SWOX	No Likely Significant Effects on the North Meadow and Clattinger Farm Special Area of Conservation. Groundwater level (Great Oolite) reduction and recovery affecting Ampney Brook. Water quality risk associated with St Peter STW. Other abstractors. Potential cumulative effects with other Cotswolds GW options (Baunton 1 and 2).	2
Gatehampton	101.5	105	3.5	3.5	SWOX	Suspension of flow constraint to allow an increase in abstraction of 3.5 MI/d.	1
Oxford Canal – Banbury	0	5 or 10	0	5 to 10	SWOX	Canal and River Trust Agreement required.	1
Kennet Valley							
Pangbourne	31	38	7	7	Kennet	Sulham and Tidmarsh SSSI unlikely to be affected. Water quality risk in Sulham Brook including that associated with Pangbourne STW.	
London							
No Category 1 options							

Table C2 Possible Category 2 Drought Permits SWOX WRZ

Source	Current licence limit (MI/d)	Potential abstraction with Drought P/O (MI/d)	Potential Gain (MI/d)		WRZ	Issues/ Risks	Priority
			Min estimate	Max estimate			
SWOX							
Baunton 1	0 (flow constraint)	6.3	0	6.3	SWOX	No Likely Significant Effects on the North Meadow and Clattinger Farm Special Area of Conservation. Impact on the River Churn. Potential cumulative effects with other Cotswolds gw options (Latton and Baunton 2).	3
Bibury	6.819	11.819	0	5	SWOX	Limited treatment capacity. Minor adverse effects on flows in the River Coln.	5
Blewbury	0	5	5	5	SWOX	Adverse hydrological and water quality effects on Mill Brook (including Blewbury Pond) and its distributary. Potentially major adverse effects on ecological features. Nitrate removal required. Located in the North Wessex Downs AONB	6
Sor Brook	4.546	4.546 or less	0	4.456	SWOX	Unlikely to give significant yield in drought. Adverse effects on flows in Sor Brook. Water quality risks (some associated with STWs). Potentially major adverse effects on ecological features.	4

Source	Current licence limit (MI/d)	Potential abstraction with Drought P/O (MI/d)	Potential Gain (MI/d)		WRZ	Issues/ Risks	Priority
			Min estimate	Max estimate			
Category 2 - Worst case SWOX							
Axford 1	6 (from April 2017)	13.1, (unconstrained licence)	0	7.1	SWOX	Moderate hydrological effects of drought permit on the River Kennet. Medium risk to water quality. Potential for cumulative effects with Ogbourne, Ogbourne emergency boreholes and Axford 2 drought permits.	10
Axford 2	13.1 (with DP)	20	0	6.9	SWOX	Major Hydrological effects from the Drought Permit on the River Kennet. Medium risk to water quality. Potential for cumulative effects with Ogbourne, Ogbourne emergency boreholes and Axford 1 drought permits.	11
Baunton 2	6.3 with DP	17	0	10.7	SWOX	No Likely Significant Effects on the North Meadow and Clattinger Farm Special Area of Conservation. Low flows in River Churn and extended recovery with adverse effects on ecology. Potential cumulative effects with other Cotswolds gw options (Latton and Baunton 1).	8

Source	Current licence limit (MI/d)	Potential abstraction with Drought P/O (MI/d)	Potential Gain (MI/d)		WRZ	Issues/ Risks	Priority
			Min estimate	Max estimate			
Ogbourne emergency boreholes	0	4	0	4	SWOX	Low yield in drought. Adverse hydrological effects on River Og. Potential for adverse effects on the River Kennet SSSI. Potential for cumulative effects with Axford drought permit.	9
Ogbourne	0 (from April 2017)	3.5	0	3.5	SWOX	Moderate Hydrological impact on the River Og and minor on the River Kennet. Moderate risk to water quality.	7

Table C1 Possible Category 2 Drought Permits- London WRZ

Source	Current licence limit (MI/d)	Potential abstraction with Drought Permit (MI/d)	Potential Gain (MI/d)		WRZ	Issues/ Risks	Priority
			Min estimate	Max estimate			
London							
Lower Thames	200	100 or more	100	100+	London	Maintaining navigable levels. Water quality in the lower freshwater R. Thames and Thames Tideway. Adverse effects on ecology. Potential for adverse effects on Langham Pond SSSI, Dumsey Meadow SSSI and Syon Park SSSI.	1
Waddon	7.6	15.5	4	7	London	Most likely estimate 4MI/d. Waddon Ponds low levels. River Wandle low flows. Water quality. Potential for Major adverse effects on ecological features (e.g. fish). Potential for seasonal adverse effects on Wilderness Island LNR, Spencer Road Wetlands LNR and Wandle Valley Wetland LNR. Amenity value of Waddon Ponds. Potential for cumulative effects with Sutton and East Surrey Water drought options.	4
Horton Kirby (Aquifer Storage and Recovery)	0	2.4	0	2.4	London	Tested but not yet licensed. Requires pump and pipeline; assumes discharge to R. Darent for augmentation sustaining abstraction from other Darent sources. There are no adverse hydrological impact associated with the drought permit.	2

Source	Current licence limit (MI/d)	Potential abstraction with Drought Permit (MI/d)	Potential Gain (MI/d)		WRZ	Issues/ Risks	Priority
			Min estimate	Max estimate			
Wansunt	13.6	19.6	0	6	London	Yield, WTW capacity.	3
Crayford	13.64	16.4	0	2.8	London	Negligible impacts on hydrology. Yield, WTW capacity.	3
Lower Thames M2 licence annual limit	665388MI (1818 MI/d)	What ever required to avoid exceeding annual limit	0	What ever required to avoid exceeding annual limit	London	Provides option to allow for continued abstraction if annual licence is reached. Does not provide DO benefit. The option would be constrained by the LTOA and so does not have further adverse impact on the R. Thames. The option does not have priority as it is not linked to drought severity in the same way as other options.	N/A
Category 2 Worst case London							

Source	Current licence limit (MI/d)	Potential abstraction with Drought Permit (MI/d)	Potential Gain (MI/d)		WRZ	Issues/ Risks	Priority
			Min estimate	Max estimate			
Lower Thames (LTOA to 0)	200 residual	200	100+	200	London	Back pumping over Teddington Weir and maintaining navigable levels. Water quality in the lower freshwater R. Thames and Thames Tideway. Adverse effects on ecology (fish migration) and invasive species. Potential for adverse effects on Langham Pond SSSI, Dumsey Meadow SSSI and Syon Park SSSI.	2
Eynsford	7.3	11.36	0	11.36	London	Groundwater levels and recovery. R. Darent low flow, water quality, high ecological sensitivity. Adverse effects on other users and angling. Cultural heritage. Potential for cumulative effects with Sundridge 1 and 2.	7
Sundridge 1	1.36 (average)	8	0	6.64	London	R. Darent low flow, high sensitivity. Water quality. Potential adverse effects on Sevenoaks Gravel Pits SSSI and ecological features. Potential for cumulative effects with Sundridge 2 and Eynsford. Potential for derogation of other abstractors.	5
Sundridge 2	1.36	12	0	10.64	London	R. Darent low flow, high sensitivity. Potential adverse effects on Sevenoaks Gravel Pits SSSI and ecological features. Potential for cumulative effects with Sundridge 1 and Eynsford. Potential for derogation of other abstractors.	6

Table C2 Possible Category 2 Drought Permits/Orders Kennet Valley/SWA/Guildford

Source	Current limit (MI/d)	Potential abstraction with Drought O/P (MI/d)	Potential Gain (MI/d)		WRZ	Issues/ Risks	Priority
			Min estimate	Max estimate			
Kennet Valley							
Fobney	72	72	10	20	Kennet Valley	Major adverse hydrological effects on the Holy Brook. Adverse effects on water quality and some ecological features. Angling. Potential impact on another abstractor identified.	2
Fobney - emergency BH's	0 in drought	25	12	30	Kennet Valley	Sustainability of yield; water quality (Reading STW).	1
Compton 1	0	5	0	5	Kennet Valley	Nitrate. Adverse effects to hydrology of R. Pang. Possible augmentation of R. Pang as alternative. Implementation when WBGWS scheme is in operation would be likely to exacerbate any delay to watercourse recovery (uncertainties remain on combined effects)	4

APPENDIX C

DROUGHT PERMITS AND DROUGHT OPTIONS

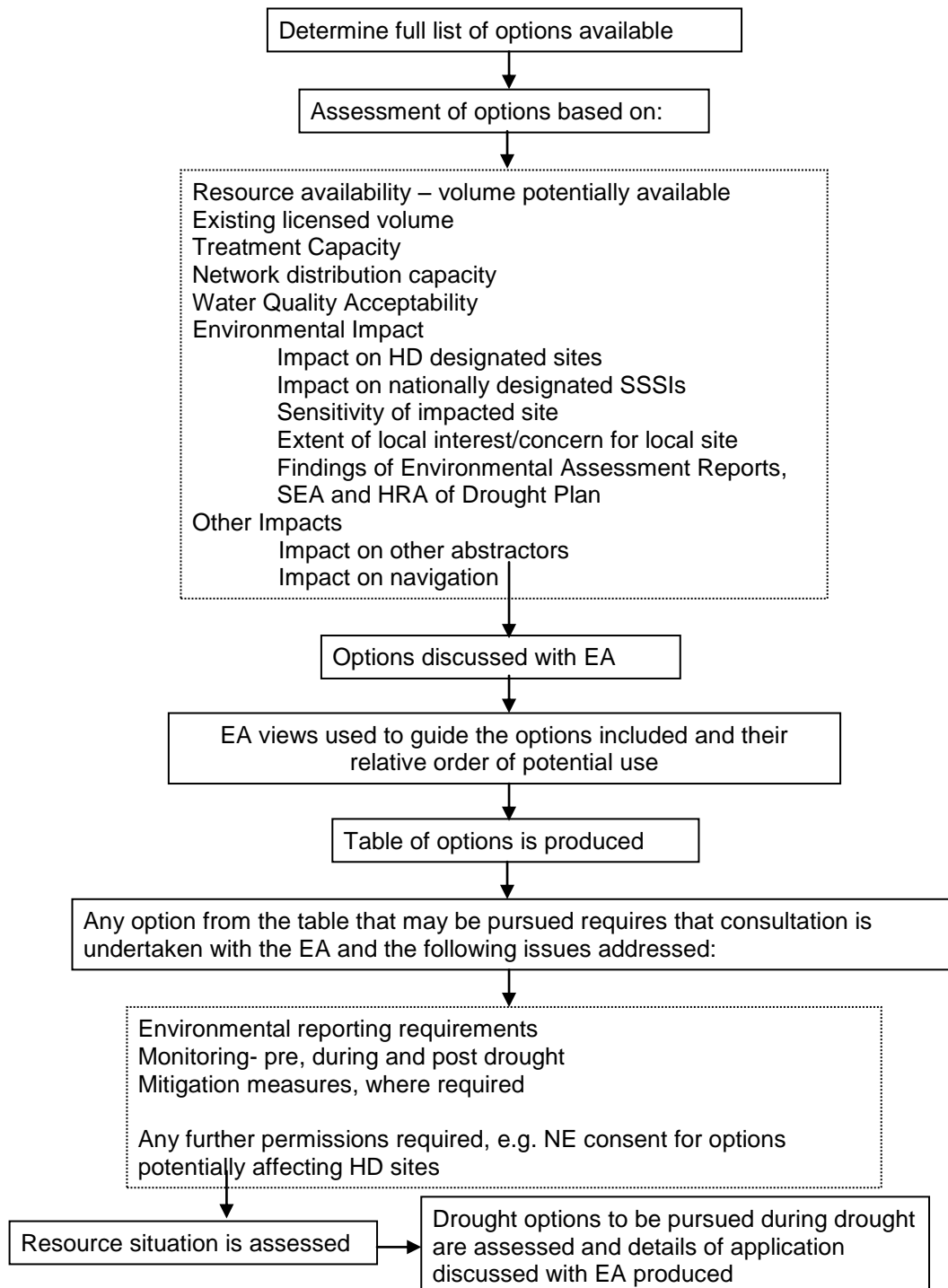
Source	Current limit (MI/d)	Potential abstraction with Drought O/P (MI/d)	Potential Gain (MI/d)		WRZ	Issues/ Risks	Priority
			Min estimate	Max estimate			
Compton 2	5 with DP	13.6	0	8.6	Kennet Valley	Nitrate. Adverse effects to hydrology of R. Pang. Possible augmentation of R. Pang as alternative. Implementation when WBGWS scheme is in operation would be likely to exacerbate any delay to watercourse recovery (uncertainties remain on combined effects)	5
Playhatch	8.2	12.3	2.8	4.1	Kennet Valley	No adverse hydrological impacts. Network restrictions on WTW output	3
SWA							
New Ground	0 (emergency licence)	6.5	0	6.5	SWA	Adverse hydrological effects on the seasonal (intermittently-flowing) River Bulbourne. Drought yield limited by pump depth.	1
Guildford							
Shalford	30	35	0	5	Guildford	Limited treatment capacity.	1
Albury	6.8	6.8	6.8	6.8	Guildford	DP only needed if flow constraint is in force to enable abstraction to continue instead of reduce to zero. Adverse effects Law Brook.	2
Henley							

Source	Current limit (MI/d)	Potential abstraction with Drought O/P (MI/d)	Potential Gain (MI/d)		WRZ	Issues/ Risks	Priority
			Min estimate	Max estimate			
Harpsden - Aggregate Sheeplands	22.3	27.9	0	5.6	Henley	Combined treatment capacity at Harpsden and Sheeplands and nitrate levels at Sheeplands	1

C2. Statutory Drought Plan – Drought Permit Decision Process

The choice of which sources are used as potential drought permit options is based on a number of factors. These are outlined in the flow diagram below.

Figure C1 Drought Permit Decision Process



C3. Description of Options for Drought Permits

C3.1 Identification of Options

The process diagram above summarises the decision making involved in the choice of drought permits for the Drought Plan. The selection of options needs to include the critical factors relating to water supply provision. This means that the options are generally restricted to existing sources due to the lead times involved in development of new options where there is no existing infrastructure. Clearly therefore, the potential for increased resource availability is the principal factor in the choice of which sources are to be selected as potential drought permit options.

There are other factors, besides the resource availability, that also need to be taken into account when considering the potential for potable supply, notably raw water quality and water treatment works available capacity. Having established that the option can provide raw water to meet potable standards, it is also important that the option can be used to provide water where it is required to help meet demand and alleviate the affects of the drought on critical supplies. This process will lead to the production of a provisional list of sources for which applications for drought permits may be made.

C3.2 Environmental and Other Impacts

Following identification of a list of options the potential impact of each of the options needs to be considered. The principal consideration will be the impact on the environment although impact on water levels for navigation and on other licensed abstractors is also clearly important. TWUL takes into account the relative environmental impact of the options available and assigns the options to Category one or Category two levels. The Category one options are those that are likely to be implemented ahead of the Category two options, principally on the grounds of lesser environmental impact although in some cases it may be necessary to implement Category two options in advance of Category one options if the specific drought conditions require it, for example if the Oxford Canal options is not available due to drought in the Midlands region. The level of environmental impact is determined in liaison with the Environment Agency and the statutory SEA consultees (Environment Agency, Natural England and English heritage) and HRA consultees (Natural England).

C3.3 Consultation with Environment Agency

The list of identified options and associated details is submitted to the Environment Agency for their views and the options are discussed in more detail. The Environment Agency's views on potential impacts are used to help determine the categories to which the options are assigned and this will be a key component of decision making in relation to the order in which the options are pursued. In many cases Environmental Assessment reports and baseline monitoring reports have been shared with the Environment Agency in advance of publishing the draft Drought Plan.

C3.4 Implementation of Options During a Drought

During a drought the implementation of options will depend upon the development of the drought situation and its impact in different water resource zones. It is important to retain flexibility in the choice of options that will be taken forward to application during a drought.

There is no single time criterion for specifying the lead time for preparing and submitting drought permit applications. The lead time required will depend upon the environmental sensitivity of the option being considered along with the preparatory monitoring needed to satisfy Environment Agency requirements. In general, for the most sensitive permits, a minimum lead in time of 10 weeks is specified. For such environmentally sensitive permits, the trigger for submission to the Environment Agency for the London WRZ is normally the point of introduction of the Temporary Use Ban (Level 3 of Levels of Service). In the case of SWOX, the trigger is either the introduction of the Temporary Use Ban or the 200Ml/d flow threshold at Farmoor, whichever is the earliest, see Sub-section 4.4.1.

The drought permit options that may need to be implemented in the London and SWOX WRZs and their timing will be determined through using the control diagrams for guidance. The trigger for the implementation of this set of options is the Level 3 control curve for London and for SWOX the Level 3b control curve or reaching at Farmoor a trigger threshold flow of 100Ml/d, whichever is the earliest, see Sub-section 4.4.1.

For the other zones the implementation of Category 1 drought permits would be consistent with a Level 3 control curve trigger.

As described above drought permits are categorised into Category 1 and Category 2. Category 1 being generally less environmentally damaging than Category 2 and therefore more likely to be implemented before Category 2 options. However, in an actual drought, other factors will also be taken into account in determining which drought permits should be applied for, such as ease of implementation and water resources contribution to areas of need. Therefore the actual order of implementation of drought permit options in a drought may vary slightly from this categorisation although the priority order given in this Appendix (C) would form the basis of the order in which options are used in a drought.

Due to the prevailing drought conditions which had affected a number of TWUL's water resource zones (WRZs), TWUL were planning for the possibility of applying for a number of drought permits / orders to be implemented in 2012. TWUL were progressing with preparing comprehensive Environmental Assessment Reports(EARs) for these drought options which, for each drought option, were based on TWUL applying for a single drought permit / order for a six month period (time-limited).

Due to the improved water resources situation following rainfall in April 2012, there was no longer a requirement for applying for these drought permits / orders for implementation in 2012. However, TWUL have made a strategic decision to progress with the completion of ten EARs on the basis that experiences over the last few months suggest that these drought permit / order options are the ones most likely to be used in the future and for which "application-ready" reports will be required. These are referred to as "Tier 1 EARs".

For the remaining drought permit / order options, whilst these options are less likely to be implemented, TWUL have prepared EARs which are intended to comply with the DPG, but which are less comprehensive than the Tier 1 EARs. These are referred to as "Tier 2 pEARs.

Therefore, Category 1 and 2 options, as described in the Drought Plan, do not necessarily correspond with Tier 1 EARs and Tier 2 pEARs as described above.

It has been agreed with Natural England and the EA that in the event of a future drought option application, EARs will refer to up-to-date SSSI conservation objectives or targets for favourable condition (noting that these are subject to review and change by Natural England on a regular basis). The basis for the assessment against the conservation objectives, including quantification of the impacts, will be agreed in consultation with Natural England.

C3.5 Potential Need for Further Options

The drought permit options list is based on consideration of the available potential options following consideration of drought scenarios and water supply capability criteria. Whilst it is intended that this list is as comprehensive as possible, it is possible that further options may become viable as drought options in the future and that a specific drought situation might necessitate the consideration of further options. Therefore it is intended that the list is part of a live document, which is amended with the addition or removal of options as they become available.

C3.6 London Drought Permit Options

C3.6.1 Increased Abstraction from the Lower Thames

The options selected for London are outlined in Table C3. The principal option is to increase the availability of raw water for abstraction from the River Thames during periods of exceptionally low flow and low storage levels in the London reservoir complex. As stated above, the trigger for the requirement for drought permits is storage reaching Level 3 on the LTCD. The Lower Thames option has been selected as the principal option because it has a direct impact on the critical strategic reservoir storage in the Lower Thames although the infrastructure to abstract the water available would be required. This option also provides the greatest potential volumetric benefit of the options available.

There is also an option to allow increased abstraction from the Lower Thames if the annual licence limit is close to being exceeded (Lower Thames annual licence limit). This option would entail increased abstraction towards the end of the calendar year under circumstances when the Lower Thames storage is refilling and so would be under conditions where river flows are likely to have recovered and so would be unlikely to have adverse environmental impact. This option does not provide DO benefit (no change to the daily limit) but avoids the exceedance of the M2 annual licence limit and so has not been assigned a priority.

The remainder of options available are abstractions from groundwater.

C3.6.2 Other London Groundwater Options

Waddon. The Waddon abstraction licence has a very low average limit compared to the peak licence limit. The drought permit option is to increase the annual limit to allow abstraction at greater rates over a longer period.

Network infrastructure constraints restrict the use of the previously included Brantwood Road scheme which is why it has been replaced with Waddon instead.

Wansunt & Crayford. The output from the sources at Wansunt and Crayford in the lower Cray Valley could potentially be increased temporarily under a drought permit.

Horton Kirby ASR. TWUL intends to develop an ASR (Aquifer Storage and Recovery) option at Horton Kirby. The scheme has been started but has not yet been fully developed and is not yet licensed. There is the potential to obtain water from this source under a drought permit subject to water treatment being installed.

Sundridge 1 and 2. An increase in abstraction at the Sundridge source could be obtained under a drought order. The source is licensed with a low average licence in relation to the peak abstraction limit and abstraction limits have been reduced following low flow investigations. A drought order to increase the permitted annual abstraction limit would allow greater abstraction at the peak rate for a greater duration.

Eynsford. There is the potential to increase the output of the Eynsford source above its current licensed volume during periods.

The priority order for the London options is based on the potential yield of the option together with the potential environmental impact. The key issues/risks to the environment are identified in the sixth column of Table C3, the environmental impacts have been assessed in detail in the SEA and HRA. The priority level assigned is indicative only and may change depending on circumstances at the time of requirement and may also be influenced through discussions with the Environment Agency. The only significant option available in London is increased abstraction from the Lower Thames to reduce the residual flow over Teddington weir. This option is therefore priority 1 to deliver a reduction to 100MI/d because it would need to be implemented at an early stage in order to deliver the significant water resource gains it could potentially provide. The further reduction to a residual flow of 0 MI/d is assigned priority 2 reflecting the potential environmental impact associated with the option. For example the existing Environmental Assessment Report (EAR) and the SEA identify the potential for exacerbating water quality issues in the upper Tideway. The Lower Thames option has not been implemented in the recent past and so the detail of how it would be delivered and the impacts that would result are not well understood. Therefore Thames Water would be likely to take a flexible approach and allow for a staged reduction towards a residual flow at Teddington of 0 MI/d which would allow for close liaison with the Environment Agency regarding the detail of the option implementation. However, in practice an application for a Drought Permit would probably need to be for a reduction to 0 MI/d in view of the time constraints that would restrict the scope for two separate applications.

The Horton Kirby ASR option (priority 2) has relatively few effects on the environment, as identified by the EAR and SEA. However, the option is dependent on the development of a store of groundwater within the aquifer that could be used for potable supply. Therefore it is included in the Drought Plan so that it can be invoked if available which may be in advance of the option being licensed for use as part of normal operations.

The Wansunt & Crayford options are priority 3. The EARs and SEA did not identify any significant adverse effects. They are situated in the lower reaches of the River Cray catchment and negligible effects on hydrology and other environmental features were identified. However, they require infrastructure modifications in order for the resource benefit to be realised.

The Waddon option does not require capital works, however, the EAR and SEA identify the potential for major adverse effects on hydrology (Waddon Ponds levels and River Wandle), adverse effects on water quality and the potential for major adverse effects on ecological features (e.g. eel). There is also the potential for seasonal adverse effects on Wilderness Island LNR, Spencer Road Wetlands LNR and Wandle Valley Wetland LNR. There is amenity value associated with the Waddon Ponds.

The Sundridge and Eynsford options are priority 6&7 respectively because of the potential to have significant adverse impact on the River Darent as identified by the Environmental Assessment Reports and the SEA of the Drought Plan. The Environment Agency has stated that they would expect to see all other options taken forward prior to these options in view of the potential impacts on the River Darent which has suffered from low flows in the past. The Sundridge option is selected in preference to the Eynsford option because it is able to provide benefit to the storage in the west London reservoirs whilst the Eynsford option does not provide this benefit due to restrictions on the network.

C3.7 SWOX Drought Permit Options

The options selected for SWOX are outlined in Tables C1 and C2. The principal option is to increase the availability of raw water for abstraction from the River Thames during periods of low flow and low storage levels at Farmoor reservoir. As stated above, the trigger for the requirement for drought permits is included on the Farmoor control curves. The Farmoor option has been selected as the principal option because the infrastructure exists to abstract the water available and it has a direct impact on the critical strategic reservoir storage at Farmoor. This option also provides the greatest potential benefit of the options available.

The remainder of options available are abstractions from groundwater with the preferred initial option the introduction of the disused Meysey Hampton summer boreholes. This would be followed by the options at Latton and then Baunton which is in Category 2.

Other options in the SWOX WRZ include increased abstraction from Gatehampton during periods when the flow constraint is in force. The drought permit option would be to allow an increase in the constrained abstraction from 101.5 to 105 MI/d.

Further options have been identified for the SWOX WRZ in order to benefit the Banbury area. These include a potential permit to abstract water from the Oxford Canal, however this option is dependent upon the water being made available by Canal and River Trust. An additional option would be to abstract from the Sor Brook when the flow constraint is in place.

The option for a drought permit at Blewbury could be used to reduce the amount of water from Gatehampton that is used locally and thereby enable greater benefit from the transfer of water from Gatehampton northwards to Oxford. This option can only be pursued if the high nitrate levels are addressed. TWUL no longer holds an abstraction licence for the Blewbury groundwater source.

The potential for increased abstraction at the Bibury source would be dependent upon the provision of sufficient treatment capability to increase the output from the source. It would also require increased network capability to enable transfer of the water to areas where it will provide benefit in reducing the impact of drought on other sources e.g. Farmoor.

The priority order for options in the SWOX WRZ is based on the potential yield of the option together with the potential environmental impact. The key issues/risks to the environment are identified in the sixth column of Table C1 and C2, the environmental impacts have been assessed in detail in the associated EARs, SEA and HRA. The priority level assigned is indicative only and may change depending on circumstances at the time of requirement and may also be influenced through discussions with the Environment Agency. The options are divided into Category one and Category two options and further indicative priority is given within each Category level. The principal significant option available in SWOX is increased abstraction from the River Thames at Farmoor through amendment of the flow constraint. This option is therefore priority one because it would need to be implemented at an early stage in order to deliver potentially significant water resource gains.

The SEA does identify the potential for some adverse environmental effects, for example in extreme circumstances, the drought option may potentially make navigation more difficult to maintain resulting in adverse effects with respect to recreation and tourism. However, the SEA highlighted five SWOX drought options as having potentially more significant environmental effects (Axford, Ogbourne, Blewbury, Sor Brook and Baunton higher abstraction). Gatehampton and the option to use the Oxford Canal are also priority 1 in view of the low environmental impacts that the options are likely to have. It should be noted that the Oxford Canal option will only be available if the water is available from the Canal and River Trust at the time of the drought). The Meysey Hampton and Latton options are priority 2 in view of the importance of these options to the drought resources that might be needed for SWOX. These options have potential to have adverse effects on watercourses but these effects are likely to be less severe than the options that would follow. The remaining options are in priority order based on potential environmental impact (as shown in the SEA) with Sor Brook priority 4 due to impact on the Sor Brook, Bibury at priority 5 due to impact on the River Coln, Blewbury priority 6 due to impact on the Blewbury Ponds, Ogbourne 7, Baunton higher abstraction priority 8 due to impact on the River Churn, Ogbourne emergency boreholes priority 9 due to impact on the River Og and Kennet and Axford priority 10 and 11.

C3.8 Kennet Valley Drought Permit Options

The principal option identified in the Kennet Valley (Table C4) is the option to vary the flow constraint condition at Pangbourne so that the use of boreholes 5 & 6 is permitted after the flow constraint has come into force. This option would be required when the supply/demand balance in the Kennet Valley is at risk due to reduced output at other sources. The SEA identified Pangbourne as having few adverse environmental effects relative to most other options in the Kennet Valley WRZ.

Other options identified in the Kennet Valley are to abstract from the Fobney emergency boreholes to supplement supplies during drought periods rather than under short-term emergency conditions. The option of increased abstraction at Playhatch has also been identified in the event of severe drought.

In more severe drought conditions the option to reduce the residual flow down the Holy Brook would be considered, however this may be possible through agreement with the Environment Agency rather than through a drought permit. This is because the residual flow requirement down the Holy Brook is not required by an abstraction licence condition. An Operating Agreement is being drawn up between TWUL and the Environment Agency to cover this residual flow requirement.

The re-commissioning of Compton pumping station has been included as an option although it is considered that this would be likely only under extreme circumstances as the re-commissioning would require substantial capital works in order for the source to be used.

Subsequent to Pangbourne the priority order for the Kennet Valley Drought Permit options is based on the volume they are able to provide together with their potential to have adverse environmental impact. The key issues/risks to the environment are identified in the sixth column of Table C4, the environmental impacts have been assessed in detail in the associated EARs, SEA and HRA. The priority 1 option is the Fobney boreholes, they provide significant potential gain and the EAR identifies the option likely to only result in minor adverse hydrological effects and relatively minor impacts on environmental features. The Fobney Direct option provides a significant gain to the principle WTW serving the major demand area in the WRZ. However, the EAR and SEA identify a major hydrological impact on the Holy Brook between the Arrowhead control structure and its confluence with the River Kennet and moderate adverse effects for a range of environmental features. Therefore, this option would be considered lower priority to the Fobney boreholes option. The Playhatch option would result in negligible environmental effects, however, it provides lower potential yield and does not provide water to the main supply source for the zone. Considering these factors Playhatch option is considered priority 3. The SEA shows that Playhatch having limited environmental effects. The Compton option is priority 4 in recognition of its potential to have adverse environmental impact on the River Pang, which has a history of suffering from low flows.

C3.9 Henley Zone Drought Permit Options

The only option considered for the Henley zone (Table C4) is the increase of abstraction from the Harpsden and Sheeplands sources which are licensed in aggregate.

There is only one option identified for Henley and so it is priority 1. The key issues/risks to the environment are identified in the sixth column of Table C4, the environmental impacts have been assessed in detail in the associated EAR, the SEA and HRA.

C3.10 Slough/Wycombe/Aylesbury Drought Permit Options

The option considered for the Slough/Wycombe/Aylesbury zone is a drought permit option to allow abstraction at New Ground pumping station.

There is only one option identified for Slough/Wycombe/Aylesbury and so it is priority 1. The key issues/risks to the environment are identified in the sixth column of Table C4, the environmental impacts have been assessed in detail in the associated EAR, the SEA and HRA.

C3.11 Guildford Drought Permit Options

The options considered for the Guildford zone (Table C4) are a variation to the abstraction licence at Albury.

The potential for increased abstraction at Shalford from the rivers Wey and Tillingbourne has been considered as an option. However it is considered very unlikely that this option would be required as the sources in the Guildford WRZ are robust to drought.

The options considered for the Guildford zone are a variation to the abstraction licence at Albury and additional abstraction from the Shalford source. Both sources have been proven to be robust to drought.

The Shalford option identified for Guildford is priority 1 because it is the option that provides potential benefit to the principal demand area of Guildford. It is also likely to have significantly less adverse impact than the Albury option which has the potential to impact on the flows in the Law Brook, which has suffered from low flows in the past. Shalford would have greater adverse effects on material assets, resource use and emissions due to its construction works.

C3.12 Further Detail on Specific Drought Permit Options

The drought permit options and potential impact are considered in more detail in Appendix B and the EARS and pEARS.

C4. Generic approach to an Environmental Assessment Report for a Drought Permit or Order Application

C4.1 Introduction

TWUL will undertake an environmental assessment of the drought option as part of any drought permit or order application in accordance with Government regulations and using the Environment Agency's Drought Plan Guideline (DPG)¹.

The DPG identifies that Environmental Assessment Reports (EARs) are required as supporting documents to any drought permit or drought order application. They are relevant to those drought options where sensitive features are likely to be subject to a major or moderate impact, or a minor impact for designated features². EARs are not required for those drought options where there is certainty that there are no such impacted sensitive features.

The DPG states that as much of the environmental assessment work should be completed as possible during a period of non-drought. Each EAR is to be prepared to assess all periods for which the drought option could be in place. TWUL prepared EARs in 2013, which currently inform the drought plan. Updated draft EARs have been prepared in 2016. In accordance with the DPG the EARs include information on:

- i. likely changes in flow/level regime, due to implementing the drought management action
- ii. features that are sensitive to these changes
- iii. likely impacts on sensitive features
- iv. mitigation that may be required to prevent or reduce impacts on sensitive features.

In accordance with the DPG, the EARs consider how the proposed drought option may affect the environment in combination with the effects of existing licences, consents and plans, including the potential for cumulative impacts of drought permit/order options implemented by neighbouring water companies.

The EARs will form the basis of an application specific EAR should an application for a drought permit/order be required in the future and will be reviewed annually and updated at the time of application. The EARs will be periodically reviewed to ensure the conclusions and recommendations remain valid. An application specific EAR will cover a period of impact for which the drought option would be in place, plus an agreed period of post-project monitoring to provide a comprehensive data set to record recovery. An individual drought permit/order covers up to a six month period. It may be the case that a drought option is required to be

¹ Environment Agency (2015). Water Company Drought Plan Guideline.

² Specifically: Special Area of Conservation, Special Protection Area, RAMSAR site, Site of Special Scientific Interest, National Nature Reserve and Local Nature Reserve.

implemented for a longer period, depending on the severity of the drought conditions, in which case a further application would be required to extend the drought powers.

C4.2 Environmental Assessment Report

The objective of this Environmental Assessment Report (EAR) is to provide an independent and robust assessment of the potential environmental effects of Drought Permit/Orders.

This EAR includes discussion of the following:

- an assessment of the likely changes in flow/level regime due to implementing the proposed drought permit;
- identification of the environmental features that are sensitive to these changes and an assessment of the likely impacts on these features;
- identification of mitigation that may be required to prevent or reduce impacts on sensitive features;
- recommendations for baseline, in-drought and post-drought permit monitoring.

The environmental assessment undertaken has been conducted in accordance with Government regulations and using the Environment Agency's Drought Plan Guideline (DPG). The revised guideline was published by the Environment Agency in December 2015. The supporting documents were issued to TWUL in July 2016 and together these documents supersede the previous DPG published by the Environment Agency in 2013. The current DPG includes recommendations for undertaking an Environmental Assessment of Drought Options, specifically drought permits and drought orders.

C4.2.1 Screening of Sensitive Sites and Features

The overall approach will follow the process documented in the updated DPG; specifically Section 3 of the Environment Agency's "Drought Plan Guideline Extra Information: Environmental Assessment for Water Company Drought Plans". Figure 1 of this DPG (replicated in Figure 3.1 below) identifies the environmental impact activities required. Two phases will be undertaken: Screening (Phase 1), and Environmental Assessment (Phase 2), which are described below.

Following the DPG Figure 1, the drought options screening process consists of two stages. Stage 1 fulfils the requirement to "Test how the water regime is affected by the proposed

³ Environment Agency Drought Plan Guidelines 2015.

actions' for each drought option. Stage 2 fulfils the requirement to "Assess environmental sensitivity" and determines the sensitivity of sites and features that are located within the zone of flow/level impact. It is important to acknowledge the basis of the assessment; i.e. impacts of drought permit implementation are assessed against what would occur in an actual drought without drought permit implementation.

Stage 1 – Hydrological and Hydrogeological Impact

Consideration is required (by the DPG) of the likely changes in flow/ level regime due to implementing the drought management action, specifically:

- identify conditions which trigger your actions
- identify any changes that your actions are likely to bring about, specifying their length and severity
- describe the likely conditions if you don't carry out your actions
- identify the extent of the area affected by your planned actions.

The hydrological information is used together with information on the other environmental features in the study area from Stage 2 - Environmental Sensitivity (see below) to identify the environmental risk of the drought permit. For groundwater schemes it is noted that impacts on groundwater may extend beyond the six month period of drought option implementation.

Stage 2 - Environmental Sensitivity

Potentially sensitive features that will be investigated in the screening will be drawn from Table 1 of the Environment Agency's "Drought Plan Guideline Extra Information: Environmental Assessment for Water Company Drought Plans" and through discussions with the Environment Agency and Natural England. This stage of the assessment will fulfil the requirement to "Identify relevant features that could be affected by drought actions including designation and status". These will include:

- designated biodiversity sites (SAC, SPA, Ramsar, SSSI, NNR and LNR) and NERC species/habitats which are located on or within 500m of the impacted reaches;
- ecological communities and, where identified, Water Framework Directive (WFD) status of designated waterbodies which contain the impacted reaches⁴;
- sensitive ecological features as advised by the Environment Agency and Natural England;
- invasive non-native species; and
- wider features which should be taken into account in determining the potential impacts of drought action implementation – specifically landscape, recreation and

⁴ Under Article 22 of the WFD, the Freshwater Fish Directive (FFD) was repealed on 22 December 2013. Protected waters under the FFD are incorporated within the WFD. Ecological status defined in the WFD sets the same protection to these protected areas for fish. In the case of Salmonid waters, this is assigned a typology in WFD status classification, specifically for dissolved oxygen saturation in rivers and dissolved oxygen concentration in lakes. Salmonid waters are rivers/lakes which, in the Environment Agency's judgement, would support a sustainable fish population dominated by salmonid species; this replaces the system of notices protecting areas through the FFD.

heritage.

Each of the identified sensitive receptors within the extent of impact will be listed, alongside a brief summary of their potential susceptibility to flow impacts. For designated sites, screening will include an indication as to whether the sites have water dependent qualifying interests. The result of screening will be documented as moderate – major sensitivity, minor sensitivity, not sensitive or uncertain, in line with Environment Agency DPG requirements.

Scoping

The screening exercise, described in Section C4.2.1, establishes a study area for each drought option (alone or cumulatively with another drought option) together with identification of relevant, sensitive environmental features within those study areas (based on the risk of them being impacted by the drought option during the period of its operation).

For each feature identified, the assessment methodology used in the EAR to identify the magnitude and significance of impact has been defined

The environmental sensitivity screening identified the outcome for each listed feature. DPG Figure 1 categorises four outcomes from the screening: uncertain; moderate-major sensitivity; minor sensitivity; not sensitive; and identifies appropriate next steps. Outcomes have been agreed with the Environment Agency and Natural England through the scoping and consultation process in 2012. The EARS/pEARS present the findings which show that a number of features were identified as either: 1) uncertain; 2) moderate-major sensitivity; or 3) minor sensitivity in a designated site⁵; the DPG identifies that further work will be required in the Drought Plan process. These features alone form the scope of monitoring, environmental assessment, and consideration of mitigation actions.

C4.2.2 Environmental Assessment Methodology

For each feature identified in the Screening and Scoping stage, the assessment methodology that has been used in each EAR to identify the magnitude and significance of impact will be defined.

The environmental assessment reports document the environmental baseline, i.e. habitats and environmental pressures (including flow and water quality) in the identified zone of impact without the drought option in place, utilising a description of the catchment, geomorphology, anthropogenic features and water quality. Key changes to the physical environment as a result of implementing a drought option have been identified and described and this information is used to frame and support the assessments of features. The aim of the Environmental Assessments is to provide:

- A clear summary of the outcome of each assessment (per feature) from which the Environment Agency can readily identify the significance of the impact when determining the drought permit/order application.
- Identification of those predicted impacts which are to be taken forward to consider additional monitoring and mitigation actions.

⁵ Specifically: Special Area of Conservation, Special Protection Area, RAMSAR site, Site of Special Scientific Interest, National Nature Reserve and Local Nature Reserve .

The impact assessment for sensitive features is feature specific and dependent on the availability and resolution of available data. Where possible, quantitative assessments has been undertaken.

The assessment considers the environmental impacts of implementing the drought options during the worst environmental conditions (i.e. a natural drought). Environmental sensitivity has been assessed considering the context of the timing of drought option implementation, i.e. the baseline environmental conditions are likely to be characteristic of severe drought. It is important to acknowledge the basis of the assessment; i.e. impacts of drought permit / order implementation are assessed against what would occur in an actual drought without drought order implementation.

The assessment of impacts on designated sites will be undertaken using professional judgement with reference to conservation objectives and condition status of habitats and species, for which a site has been designated. The ecological assessment will be undertaken recognising the IEMA⁶ and the IEEM study guidelines⁷. The assessment of impacts on other environmental receptors e.g. navigation and landscape will be carried out largely by qualitative expert judgement. Specific assessment methodologies will be developed for several key environmental features (as well as for geomorphology). The assessment methodologies are presented as an Appendix in each EAR and include method statements for the following:

- Geomorphology
- Flow pressures
- Water quality pressures.
- WFD Status: Fish
- WFD Status: Aquatic macroinvertebrates
- BAP species, designated sites and other sensitive fauna and flora.

Regarding abstractions, "other abstractors", including other water company public water supplies and non-public water supply abstractions, are features that have been reviewed within the assessment. Other abstractors could potentially be affected by changes to groundwater levels or surface water flows and levels as a result of implementation of the drought permit / order.

C4.3 Environmental Report Structure

The EARS has been prepared in accordance with Government regulations and good practice guidance, including:

- The updated DPG and associated appendices, issued to TWUL in July 2016
- Defra (2016) Drought Plan Direction

⁶ IEMA (1999) Guidelines for Ecological Assessment. Institute of Environmental Management and Assessment.

⁷ IEEM (2002) Guidelines for Ecological Impact Assessment: Amended Pilot, November, 2002.

- Institute of Environmental Management and Assessment (2004) Guidelines for Environmental Assessment
- Chartered Institute of Ecology and Environmental Management (CIEEM) (2016) Guidelines for Ecological Impact Assessment.
- UKWIR (2007, updated 2011) Strategic Environmental Assessment – Guidance for Water Resources Management Plans and Drought Plans. Prepared by Cascade Consulting.

Table C5 outlines the key components for inclusion, based on Section 1.2.3 of the Defra guidance (2011).

Table C5 Environmental Report Contents, after Defra 2011

Environmental report contents		Additional information notes
1	A summary of the main environmental report using non-technical language.	This should include a synopsis of major conclusions, controversial issues, unresolved issues and options selected.
2	A description of the proposal including details of the site, location and duration.	Include maps and plans.
3	A statement of need for water	This can be kept brief as the detail will be elsewhere in application.
4	Details of alternative sources considered	This should demonstrate justification for the proposed option
5	Description of the current environment (such as the aquatic and physical environment and associated habitats) and its setting in a national/regional/local context.	This should include existing features and, if already in a prolonged drought, whether there are any recognised impacts. Key information includes: <ul style="list-style-type: none"> ▪ the importance of the site (international and domestic designations) ▪ Water Framework Directive classification status and any associated issues relating to the site ▪ surface flow and groundwater data ▪ ecological and habitat sensitivity to flow / level changes and supporting data ▪ heritage/culture value ▪ current abstractions.

Environmental report contents		Additional information notes
6	Identification and prediction of impacts on the current environment.	This should include short and long term (acute and chronic) direct and indirect, cumulative, and permanent and temporary effects. It should be at the point of change and downstream and include water quality, in-river needs, associated wetlands, other water users and navigation and recreation. The assessment should focus on the features sensitive to flow/level alteration and should be quantified where possible, showing change from base level. Details on the quality of the data used, analysis/modelling and interpretation methods and the range of uncertainty should be included as well as appendices to present data and references to date source.
7	Mitigation measures	Where significant effects are identified, a description of the measures to be taken to avoid, reduce or remedy these effects should be included. Any proposed or actual agreements to minimise impacts on other users (for example lawful abstractors) should also be included.
8	Additional information to enable an appropriate assessment of environmental impacts, where a proposal could have an adverse impact on a Habitats Directive site.	The scope and content of this assessment will vary depending on the case but it must relate to the specific site and its conservation objectives.
9	Additional information to enable the authority under section 28G of Wildlife and Countryside Act 1981 (as amended by the Countryside and Rights of Way Act 2000) to fulfil its duties, where a proposal can affect a SSSI site	The scope and content of this assessment will vary depending on the case but it must relate to the specific site and its conservation objectives.
10	Monitoring plan, where proposed	This should include details of what evidence/data collection will be undertaken including locations, timings and frequency.
11	Any further information relevant to impact on water users and environment	
12	Conclusions	This should draw together and summarise the reasoning (for and against) the proposals.
13	Appendices	Such as methodologies used; data/evidence and surveys taken or planned.

C4.4 Monitoring and Data Collection

C4.4.1 Baseline Monitoring

Each EAR is based on information available at the time of writing. This includes: information provided in previous reports and studies, Environment Agency and TWUL routine monitoring data and other bespoke data.

Data requirements to undertake the environmental assessment of this drought permit have been determined by the requirements of 5 the “Drought Plan Guideline Extra Information: Environmental Assessment for Water Company Drought Plans” in the updated DPG; through knowledge of the range of Environment Agency routine monitoring data and other data available in TWUL operating area; together with an understanding of the appropriate level of detail required to undertake the assessment.

To assist in the development of drought permit / order applications additional baseline environmental surveys have being undertaken (2012 -2016). The baseline monitoring output will provide further targeted information to supplement the datasets already used in each EAR. Analysis of the additional data collected will be undertaken and where this identifies any material differences to assumptions made in each EAR, the environmental assessment and / or Environmental Monitoring Plan will be updated where appropriate following discussion with the Environment Agency. This baseline monitoring is distinct from the monitoring that will be undertaken in a drought as part of a drought permit / order application, as specified in the Environmental Monitoring Plan. Baseline monitoring will comprise walkover surveys to identify the extent and location of flow sensitive habitats and inform subsequent monitoring of habitats, sensitive communities and species, where appropriate.

Table C6 provides examples of information normally necessary to gather for the baseline. Where applicable, likely sources of supporting data are included.

Table C6 Examples of Monitoring and Data Collection for Drought Permits/Orders

Data	Method	Required frequency & location	Source
Flow gauging	In stream structures or gauge boards with rating curves	Continuous (daily) to provide flow accretion profiles	EA
Hydrometric surveys	Cross section surveys, ADCP meters, or current meters	Spot flows, velocities, levels and Cross-sectional areas.	Various or to be commissioned
Water Quality sampling	Routine sampling (various determinands)	Fortnightly or monthly depending on determinand.	EA
Water Quality samples	Spot samples for dissolved oxygen (DO), temperature and Ammoniacal N. Also Chlorophyll-a.	From weekly to monthly – measure upstream and downstream of discharges, close to ecologically sensitive reaches and to infill between EA routine samples	Various or to be commissioned
Macro-invertebrates	Kick sampling, records. (or Surber sampling if conditions appropriate)	From fortnightly to bi-monthly dependent on season for ecologically sensitive reaches. Ecological surveys to tie in with Hydrometric and water quality sampling sites.	EA or to be commissioned. Most is field surveying supported by earlier EA records
Fish Surveys	Electric fishing	Spring and late summer electric fishing of adults is a typical approach. More specific surveys of spawning habitat, fry and/or juveniles possibly required depending on period of Drought Permit operation.	EA records or to be commissioned

Data	Method	Required frequency & location	Source
Macrophytes	Walkover surveys mapping in-channel flow dependent habitats and/or River Habitat Surveys (RHS)	Monthly to bi-monthly primarily from spring to later summer on reaches providing representative habitats	EA, NE or to be commissioned

Protected species (where applicable) – the presence of protected species may require consideration of additional surveys to confirm presence/absence at targeted locations.

Please note that the above table is indicative only. The components of any monitoring programme attached to a specific drought permit/order would vary according to factors such as location and seasonal impacts relating to the life stages of particular species.

C4.4.2 Groundwater Source

As well as data listed above, a groundwater source would also require the following additional data.

Data	Method	Required frequency & location	Source
Aquifer water table levels	Monitoring boreholes (piezometers)	Daily (preferable) or monthly near to abstraction source and to ensure impact of fault lines creating a hydraulic barrier to groundwater flow is assessed. Allows direction of groundwater flow to be assessed.	EA

C4.4.3 Other Data

Once the baseline is established, it will be necessary to collect further data to assist in the impact assessment.

Data	Method	Required frequency & location	Source
Other users	Navigation surveys	Daily to weekly information on boat movements during period of DP assessment	EA, local sailing clubs
Other Users	Angling numbers – surveys	Seasonal numbers on estimated angling activity	Angling clubs or Consultatives, NE, EA.
Abstraction licences in catchment	EA records	For both affected river catchments and aquifer watershed (for a groundwater source)	EA
Permitted discharges	EA records or from discharger	For all watercourses hydraulically linked to the surface water source or aquifer	EA or direct to discharger

C4.5 Drought Permit Monitoring and Mitigation

The DPG identifies in Section 7.3 the specific requirements for mitigation of serious impacts on the environment as a result of implementing a drought option. The assessments undertaken in each EAR confirm the features requiring consideration of mitigation and appropriate monitoring triggering mitigation. Appropriate mitigation actions identified are both available and practicable. A mechanism will be established for further consultation with Environment Agency or other parties on the proposed mitigation leading to agreement prior to an individual drought permit/order application.

Environmental Monitoring Plan

The DPG identifies the specific requirements for monitoring. The assessments undertaken in each EAR confirm the features requiring consideration for monitoring prior to, during, or after implementation of a drought permit. The Environmental Monitoring Plan includes the following:

- the feature/s to be monitored and the methods used
- the location of survey sites (including maps where appropriate)
- the timing and frequency of monitoring
- who will undertake the monitoring
- monitoring required linked to any specific mitigation actions
- monitoring required for post-drought assessment of site.